

Sexually Transmitted Infections: An Evidence-Based Online Course

Module 4:
Screening and diagnosis of sexually transmitted infections

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Abbreviations and acronyms

AMR	**Antimicrobial resistance**
CS	Congenital syphilis
CT	Chlamydia trachomatis
eMTCT	Elimination of Mother-to-Child Transmission
GBD	Global burden of disease
HIV	Human immunodeficiency virus
MSM	Men who have sex with men
NG	Neisseria gonorrhoeae
PID	Pelvic inflammatory disease
POC	Point-of-Care
RDTs	Rapid Diagnostic Tests
STI	Sexually transmitted infection
TP	Treponema pallidum
TV	Trichomonas vaginalis
VDS	Vaginal discharge syndrome

Module objectives

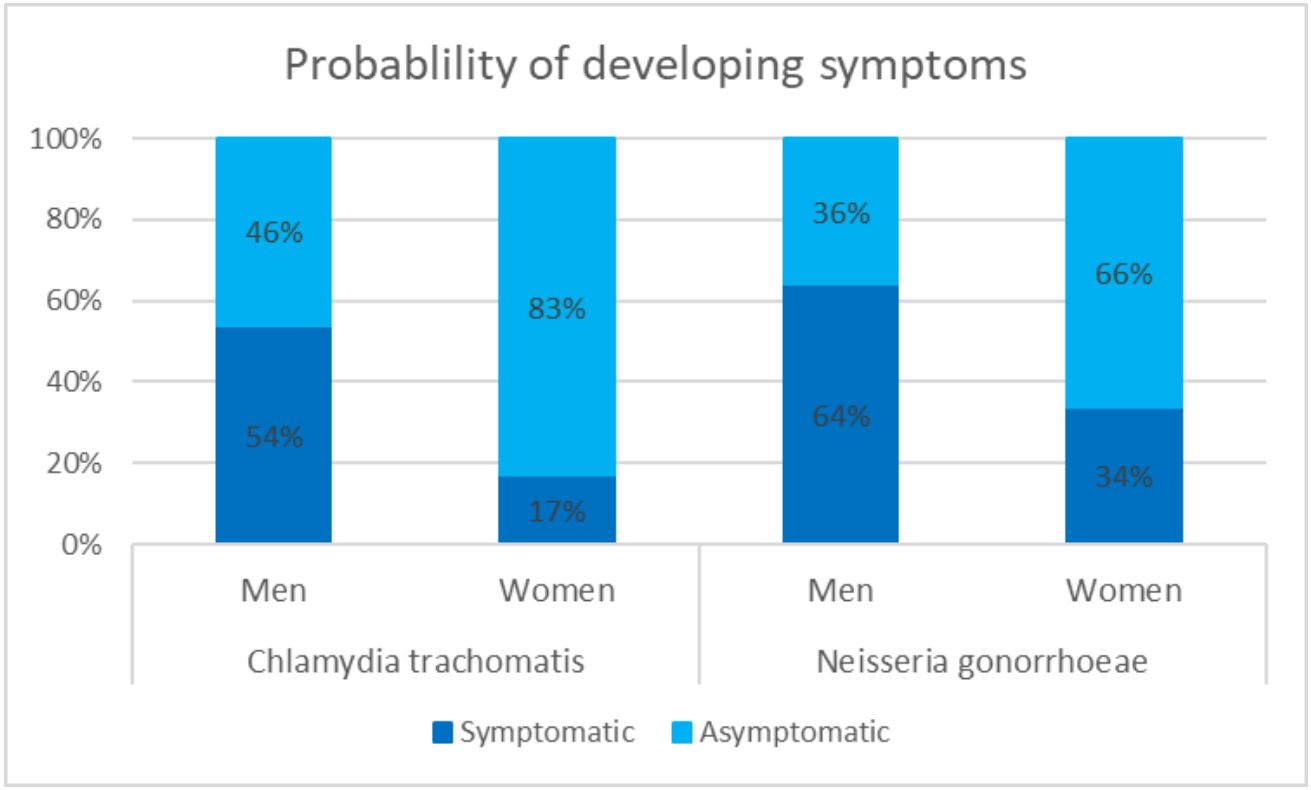
By the end of this module, the learner should be able to:

- Know the objectives and potential impact of diagnostic testing in STIs
- Be familiar with the main types of tests used for chlamydia, gonorrhoea and syphilis diagnosis
- Understand the pros and cons of point-of-care and rapid diagnostic tests
- Gain insight into technological gaps and the innovation pipeline in STI screening and diagnosis

Module outline

- **Role of diagnostic tests in STIs**
  - Objectives and potential impact
- **Tests for *Chlamydia trachomatis* and *Neisseria gonorrhoeae***
  - Technology landscape
  - Point-of-care (POC) test considerations
- **Tests for syphilis**
  - Tests at different stages of infection
  - Rapid diagnostic tests for syphilis screening in pregnancy
  - Non-serological tests for syphilis
  - Technological gaps and innovation

Sexually transmitted infections can be symptomatic or asymptomatic



Parameters used in GBD (global burden of disease) estimations

- Most cervical CT (Chlamydia trachomatis) and NG (Neisseria gonorrhoeae) infections in women remain asymptomatic
- Urethral infection in men can be symptomatic or asymptomatic
- Anorectal and oropharyngeal infection is mostly asymptomatic (not shown)
- Syphilis

Diagnostic tests for sexually transmitted infections

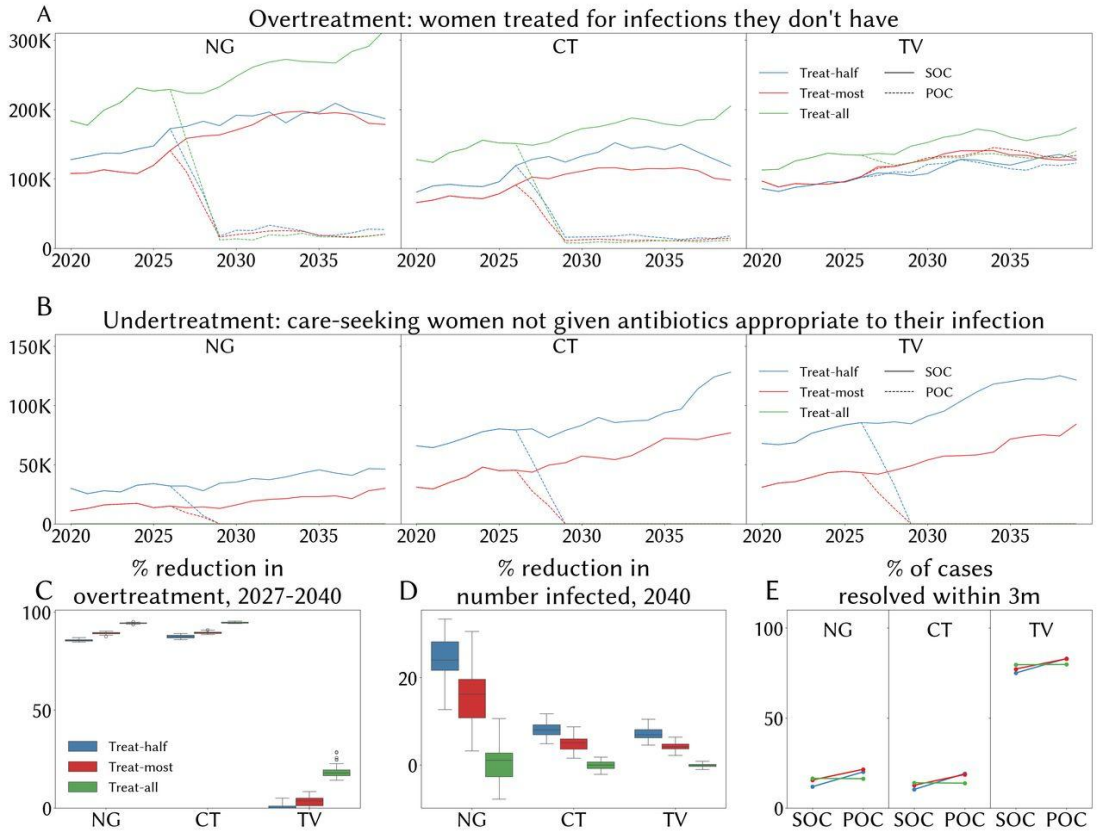
Objectives of diagnostic test for STIs

1. Strengthen management of **symptomatic infection**: optimize syndromic management, reduce unnecessary antibiotic use and target partner services
2. Identify and treat **asymptomatic infection** to avert complications through screening
3. Reduce population-level incidence and prevalence

Objective	Implication	Impact
Optimization of syndromic management for STIs	Pathogen-directed treatment of symptoms	- Reduced antibiotic use (stewardship) - Targeted partner management - Treatment outcomes - Reduced population-level incidence and prevalence
Screening at-risk people for asymptomatic STIs	Detection and treatment of asymptomatic infection	- Reduced burden of infection - Reduced burden of complications, sequalae and adverse outcomes - Reduced population-level incidence and prevalence

Peters RPH et al. Lancet 2025

Impact of a diagnostic test in syndromic treatment



In Zimbabwe, implementation of diagnostic test for women with VDS (vaginal discharge syndrome) would:

- Dramatically reduce overtreatment and unnecessary use of antibiotics
- Impact depends on design and implementation fidelity of syndromic treatment algorithm
- Be expected to reduce NG/CT burden by up to 24%/15% by 2040

Stuart R et al. Sex Transm Infect 2026

Impact of a diagnostic test to identify and treat asymptomatic infections

Chlamydia and gonorrhoea screening: who and why to screen, and how often?

Adolescent girls and young women

PID (Pelvic inflammatory disease) and tubal-factor infertility (TFI)

- RCT data: modest reduction in PID largely among women with prevalent infection
- NECCST (observational): PID risk associated with symptomatic but not asymptomatic chlamydia
- Observational studies suggest TFI risk ↑ associated with chlamydia
- Limited impact on population burden of infection
- No data from high-incidence settings → Gates-funded trials

Pregnant women

Adverse pregnancy outcomes

- Pooled analysis of observational studies: 2-3x risk ↑
- WANTAIM trial: no effect on composite outcome but effect in NG-infected sub-group
- Philani Ndiphile trial: no effect on composite outcome but effect on PTB in two-time screening group
- Limited impact on population burden of infection
- PROMISE trial to provide required evidence on this approach

Men who have sex with men

New (symptomatic) infections

- Limited direct clinical benefit for the individual but potential public health benefit through reduced transmission
- Limited direct evidence of population-level impact
- Impact on antimicrobial resistance of repeat screening and treatment

Impact on HIV transmission and acquisition?

- NECCST (Netherlands Chlamydia Cohort Study)
- WANTAIM trial (Women and Newborn Trial of Antenatal Interventions and Management)

Overview of the most relevant diagnostic test types

	Preferred diagnostic test	Antimicrobial resistance (AMR) detection	Comment
Chlamydia trachomatis	Antigen detection (lateral flow assay) Molecular technology (NAAT)	-	Resistance rare (cell-culture required)
Neisseria gonorrhoeae	Microscopy (urethral discharge smear) Antigen detection (lateral flow assay) NAAT and other molecular technology	Culture and AST DNA sequencing	Fastidious organism --> suboptimal culture recovery
Trichomonas vaginalis (TV)	Microscopy (vaginal discharge smear) Molecular technology (NAAT)	-	Resistance uncommon but treatment failure occurs for other reasons
Mycoplasma genitalium	NAAT and other molecular technology	DNA sequencing	Intracellular (cell-culture required)
Treponema pallidum	Microscopy (ulcer) Antibody detection (lateral flow assay)	DNA sequencing	Spirochete; culture not available (rabbits) Resistance to BPG never identified
Herpes simplex virus	NAAT or other molecular technology	DNA sequencing	-
Haemophilus ducreyi	NAAT	-	Fastidious organism --> suboptimal culture recovery

AST (Aspartate Aminotransferase), NAAT (Nucleic Acid Amplification Test)

Target product profile for POC STI test: when is it good enough?

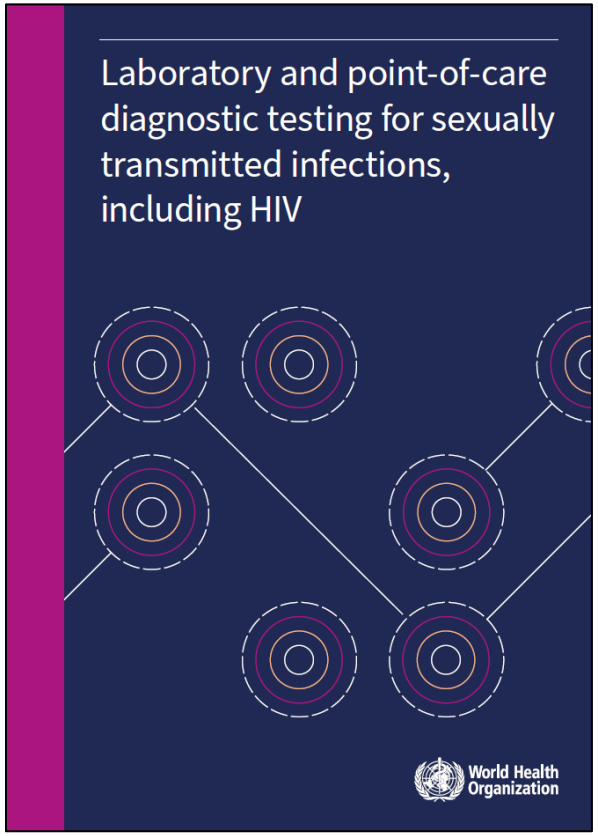
Characteristic	Minimal requirement	Optimal requirement
Scope of the test		
Intended use	To detect *Neisseria gonorrhoeae* (NG) only or NG and *Chlamydia trachomatis* (CT) infection to improve patient management and facilitate appropriate antibiotic use	Same as minimal, plus to assist in screening to identify previously undetected NG or NG and CT infections
Target use setting	Primary health care settings including health posts (Level 1); to be used after initial clinical evaluation (referring to Step 2 in the WHO vaginal/urethral discharge flowchart) to guide treatment decision	
Test format / Equipment	A non-instrumented, single-use, disposable diagnostic test preferred; ideally no additional power required for operation, but if required, battery power with 8-hour operation between charges Reader optional and only appropriate if its inclusion supports enhanced test performance	
Performance characteristics		
Clinical sensitivity to predict resistance	>80% required to achieve the minimal intended use for a non-molecular test >95% required to achieve the minimal intended use for a molecular test	>90% required to achieve the minimal intended use for a non-molecular test >95% required to achieve the minimal intended use for a molecular test
Clinical specificity to predict resistance	>95% required to achieve the minimal intended use	>98% required to achieve the optimal intended use
Time to result	≤30 minutes	≤10 minutes
Pricing		
Target list price per test (excluding the cost of a reader)	<$3 USD for a low complexity test (e.g. rapid diagnostic test) that meets the minimal intended use and clinical sensitivity and specificity TPP specifications	<$12 USD for a moderate/high complexity test (e.g. disposable single-use molecular test) that meets the optimal intended use and clinical sensitivity and specificity TPP specifications



- Target product profile to guide test development
- REASSURED criteria to be considered as well
- WHO pre-qualification process is currently underway
  - Molecular test for CT/NG/TV
  - Antigen test for NG
  - Antigen test for CT

WHO. POC tests for STIs, 2023
Ferreyra C et al. PLoS One 2020
Land KJ et al. Nat Microbiol 2019

Technology landscape: STI POC tests are available





- Molecular STI POC tests are available and used for CT/NG/TV diagnosis (e.g. binx; GeneXpert; Visby)
- Rapid antigen-based STI POC tests have been successfully developed for NG and TV
- Large pipeline of molecular and antigen tests in development leveraging COVID-19 technology
- Cost, electricity and equipment dependency and ease-of-use are important features for LMICs

When is a point-of-care diagnostic test fast enough?

Table 1. Time to Treatment Initiation After Point-of-Care Sexually Transmitted Infection Testing at 4 Primary Healthcare Facilities in South Africa

	Women, No. (%)				
Timing of Treatment Initiation Relative to Testing	Facility A (n = 27)	Facility B (n = 39)	Facility C (n = 34)	Facility D (n = 25)	Total (n = 125)
Same day	26 (96)	7 (18)	9 (26)	7 (28)	49 (39)
After 1–7 d	0	19 (49)	13 (38)	11 (44)	43 (34)
After >7 d	0	10 (26)	7 (21)	4 (16)	21 (16)
No return for treatment	1 (4)	3 (8)	5 (15)	3(12)	12 (10)

Martin et al. BMC Health Services Research (2022) 22:171
https://doi.org/10.1186/s12913-022-07557-7

BMC Health Services Research

Table 4 Reasons for not waiting for STI test results, or for changing intention

"What is your main reason, why you are not intending to wait today?"	Overall (n = 217), n (%)
Have to get back to my kids/family	66 (30)
Have to get to work/school	60 (28)
Hungry	29 (13)
Want to go to the shop	26 (12)
Not feeling well	11 (5)
No time/going somewhere	8 (4)
Load shedding	5 (2)
Referred to hospital	4 (2)
Too hot	2 (1)
Boring	2 (1)
Transport availability	1 (0.5)
No space to wait	1 (0.5)
Didn't come alone to the clinic	1 (0.5)
Tired	1 (0.5)

RESEARCH ARTICLE Open Access

"It was difficult to offer same day results": evaluation of community-based point-of-care testing for sexually transmitted infections among youth using the GeneXpert platform in Zimbabwe

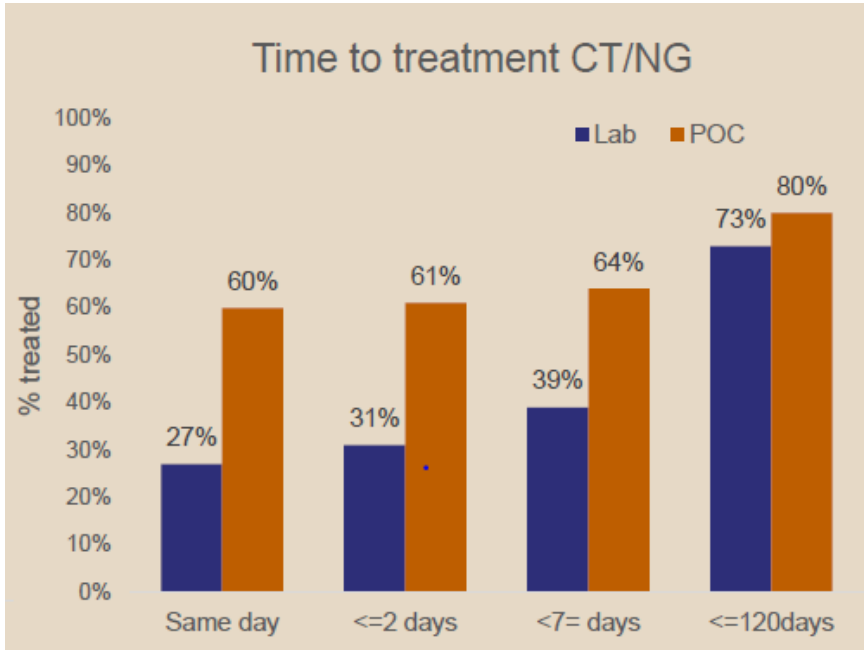
Kevin Martin[1,2*], Chido Dziva Chikwari[2,3], Constance R. S. Mackworth-Young[2], Mutsawashe Chisenga[3], Tsitsi Bandason[3], Ethel Dauya[3], Ioana D. Olaru[2,3], Suzanna C. Francis[4], Constancia Mavodza[4,5], Portia Nzombe[3], Rangarirayi Nyamwanza[3], Fadzanai Hove[3], Maureen Tshuma[3], Anna Machiha[6], Katharina Kranzer[2,3,7†] and Rashida A. Ferrand[2,3†]

"Most clients did not want to wait for their results they just said they will leave their details and they will collect next time when they come. They were few who were willing to wait, and it was mainly boys who then went to the social area to play but no girls waited for their results. They said they had to go back home and do other chores that needed to be done."

Mdingi MM et al. Cin Infect Dis 2023
Martin K et al. BMC Health Serv Res 2022
Gigi RMS et al. BMC Health Serv Res 2024

Treatment outcomes for POC vs laboratory-based STI screening

- **POC testing increases treatment coverage and time to treatment**



PHC programme for First Nations People in remote Australia

	Overall		Laboratory STI Testing (Nov 12, 2020–Oct 5, 2021)			Point-of-Care STI Testing (Aug 23, 2019–Nov 11, 2020)			
	n	% of Total	n	% of Laboratory Tested	(%)	n	% of POC Tested	(%)	*P*
Total	1194	(100)	548	(100)	(46)	646	(100)	(54)	
Maternal age, y									
Median, IQR	26	(22–31)	27	(22–31)		26	(22–30)		
<24	399	(33)	183	(33)	(46)	216	(33)	(54)	0.99
Education <grade 12	580	(49)	267	(49)	(46)	313	(48)	(54)	0.93
Employed	428	(36)	174	(32)	(41)	254	(39)	(59)	**0.01**
Gravidity									
Primigravida	405	(34)	180	(33)	(44)	225	(35)	(56)	0.47
Multigravida	789	(66)	368	(67)	(47)	421	(65)	(53)	
Gestational age, wk									
Median (IQR)	21	(15–31)	22	(15–32)		21	(14–29)		
<20	504	(42)	219	(40)	(43)	285	(44)	(57)	0.15
Cohabiting with partner	441	(37)	211	(39)	(48)	230	(36)	(52)	0.30
Initiated PrEP at baseline	1009	(85)	427	(78)	(42)	582	(90)	(58)	**0.00**
Confirmed PrEP uptake following prescription* (n = 1009)									
No	15	(1)	7	(2)	(47)	8	(1)	(53)	**0.00**
Yes	826	(82)	382	(89)	(46)	444	(76)	(54)	
Unconfirmed/lost-to-follow-up	168	(17)	38	(9)	(23)	130	(22)	(77)	
Never initiated PrEP	131	(11)	89	(16)	(68)	42	(7)	(32)	
Initiated PrEP at a follow-up visit	54	(5)	32	(6)	(59)	22	(3)	(41)	
Any STI diagnosis (CT and/or NG)	334	(28)	152	(28)	(46)	182	(28)	(54)	0.87
CT and NG coinfection	48	(4)	24	(4)	(50)	24	(4)	(50)	0.56
CT diagnosis	285	(24)	124	(23)	(43)	161	(25)	(56)	0.35
NG diagnosis	97	(8)	52	(9)	(54)	45	(7)	(46)	0.11
TV diagnosis†	75	(6)	N/A			75	(12)	(100)	
Timing of STI treatment									
Treated on different day as diagnosis	140	(42)	109	(72)	(73)	31	(17)	(27)	**<0.001**
Treated on same day as diagnosis	143	(43)	0	(0)	(0)	143	(79)	(100)	
Not treated	51	(15)	43	(28)	(79)	8	(4)	(21)	

Pregnant women

Adapted from: Causer LM et al. Lancet Reg Health Western Pac 2024

Does POC STI testing impact on population burden?

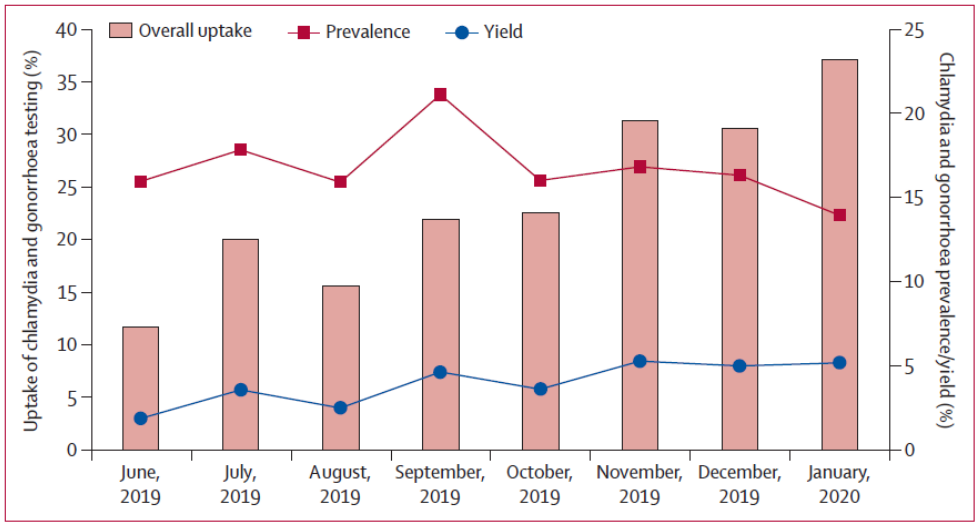


Figure 2: Prevalence of chlamydia and gonorrhoea, and uptake and yield of testing

Integrated HIV and SRH services for youth in Zimbabwe

- High acceptability of POC screening for chlamydia and gonorrhoea in almost all populations
- Preferred specimen types
  - Urine (men)
  - Vaginal or endocervical swab
- Despite high acceptability of STI testing facilitated by awareness programmes – is uptake and frequency high enough for population impact?

Martin K et al. Lancet Child Adolesc Health 2021
WHO. Laboratory detection of STIs

The importance of implementation for impact

- **Systematic review shows that understanding implementation is crucial for success of POC**



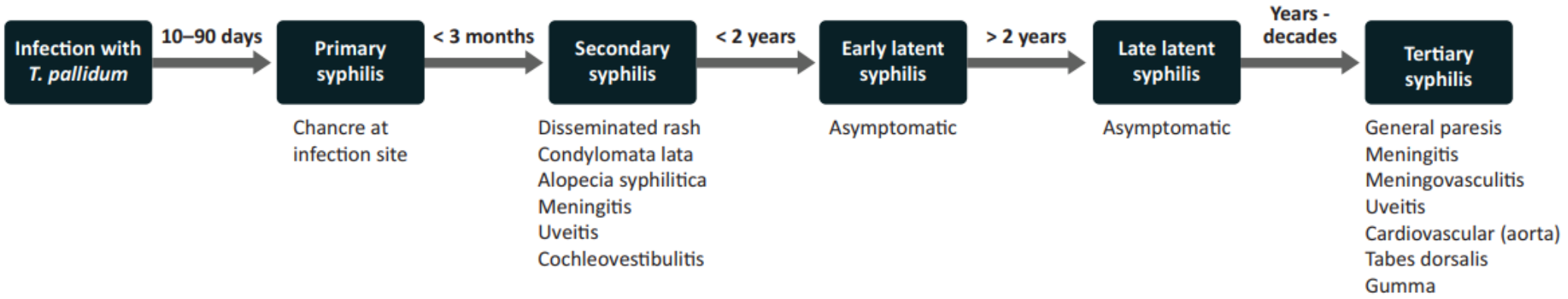
Fig. 2 Tree map showing thematic analysis of facilitators and barriers to point-of-care testing for STIs in LMIC (the area associated with individual themes and sub-themes is proportional to the number of different sources coded)

Main facilitators and barriers

- Client factors
- Ideal test characteristics
- Policy, infrastructure and organization
- Healthcare provision
- Training, audit and feedback
- Reach and testing in remote areas
- Dual testing

Martin K et al. BMC Infect Dis 2022

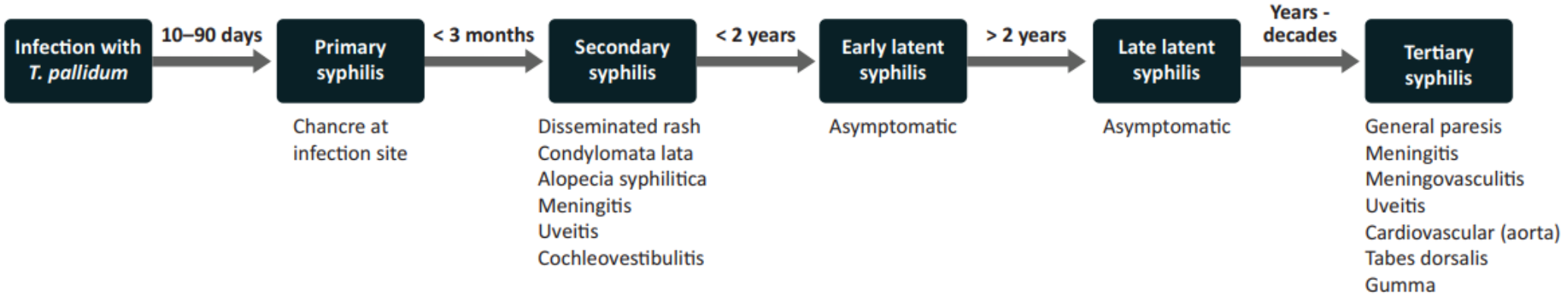
Natural history of syphilis



- Only 30%-40% of people notice an ulcer (which is self-limiting): most syphilis cases are asymptomatic when diagnosed
- Infectiousness highest in the earlier stages of syphilis and declines over time: importance of clinical case management to reduce transmission/incidence

Peters RPH et al. S Afr J HIV Med 2024

Diagnostic tests in the context of natural history for syphilis



Diagnostic tests for (early) clinical disease

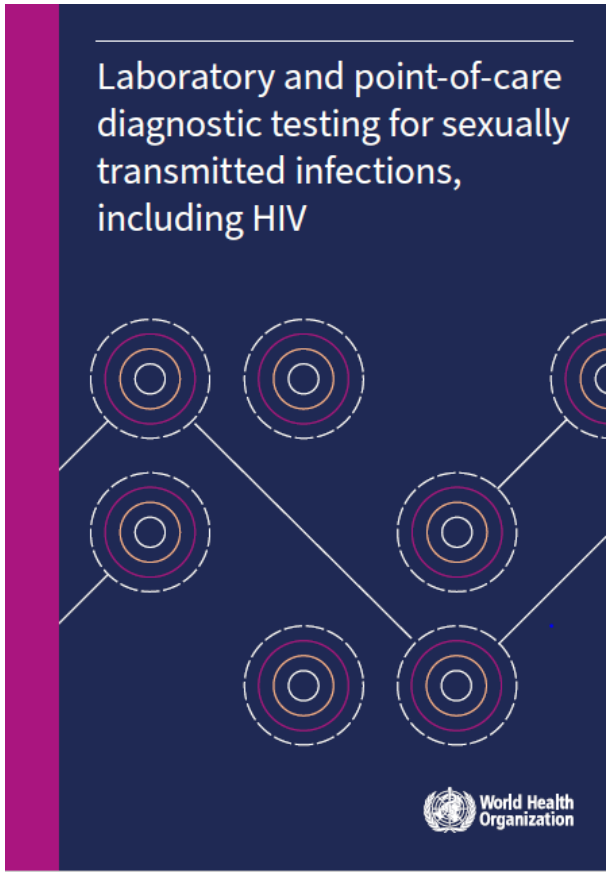
Improve treatment outcomes
Prevent progression and transmission

Screening tests to diagnose asymptomatic infection

Prevent complications (e.g. pregnancy)
Reduce population burden

Peters RPH et al. S Afr J HIV Med 2024

Syphilis diagnostic tests



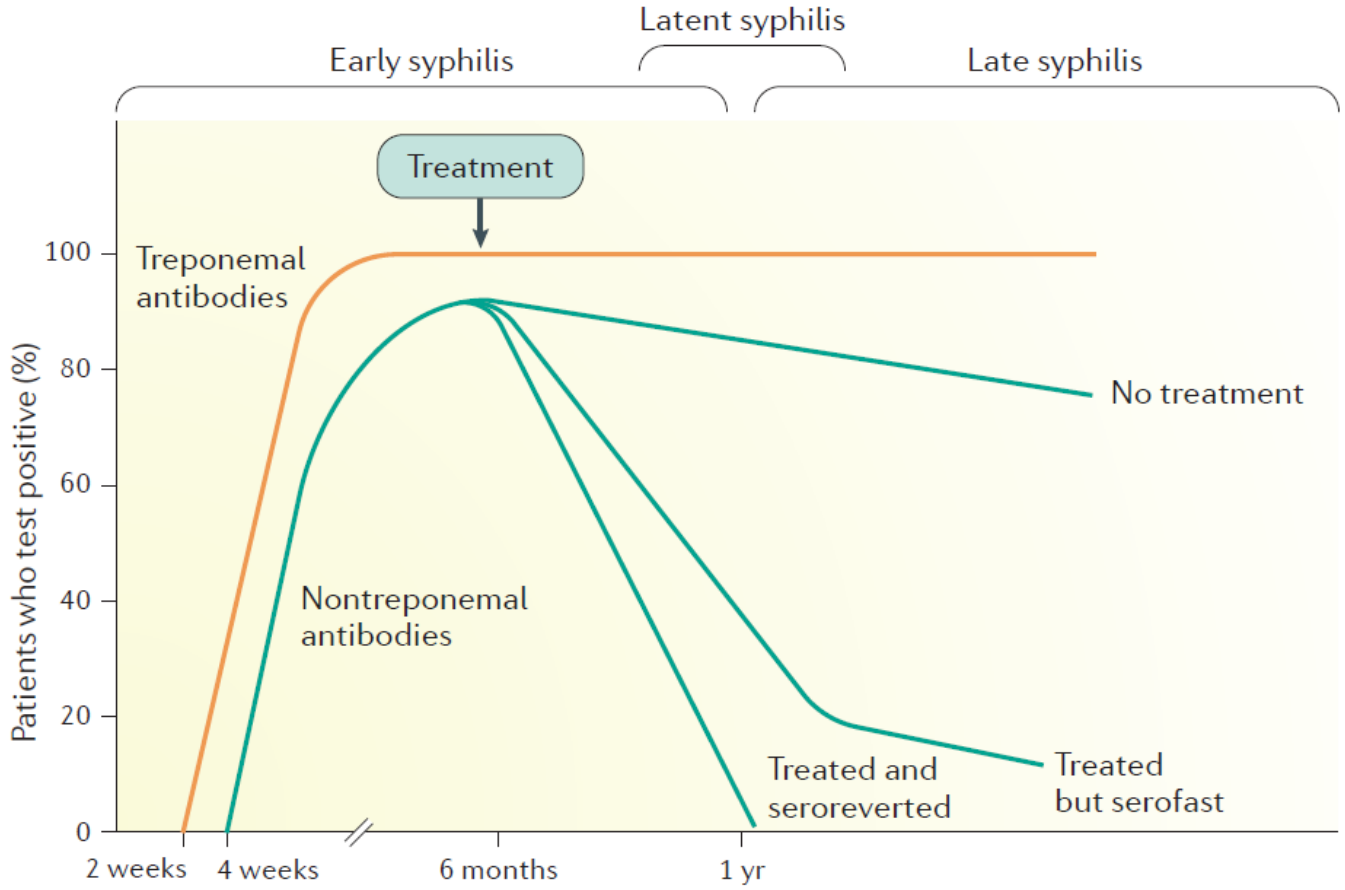
Syphilis diagnosis requires:

- Detection of Treponemal spirochetes **OR**
- Positive result in two unrelated serological assays

Use of diagnostic tests:

- Diagnosis of clinical disease
- Screening for asymptomatic infection

Serologic response to *Treponema pallidum* infection



- Ulcer(s) typically appears around 3 weeks after exposure (10-90 days)
- Serological response takes time and occurs in response to infection
  - Less than 50% positive at 4 weeks
  - 80% at approximately 8 weeks
- Serological tests may be negative in primary syphilis
- Negative serology does not rule-out syphilis in people with genital ulcer

Peeling RW et al. Nat Rev Dis Primer 2017

WHO pre-qualified (PQ) tests for syphilis screening

PQ year	Product Name	Manufacturer	WHO evaluation Final sensitivity	WHO evaluation Final specificity
2020	Standard Q HIV/Syphilis Combo Test	SD Biosensor	HIV: 100% Syphilis: 95.5%	HIV: 99.5% Syphilis: 99.5%
2019	First Response HIV 1+2 Syphilis Combo Card	Premier Medical Corporation	HIV: 100% Syphilis: 99%	HIV: 99.5% Syphilis: 100%
2015	Bioline HIV/Syphilis Duo	Abbott Diagnostics	HIV: 100% Syphilis: 87.0%	HIV: 99.5% Syphilis: 99.5%

PQ year	Product Name	Manufacturer	WHO evaluation Final sensitivity	WHO evaluation Final specificity
2022	Determine Syphilis TP	Abbott Diagnostics	100%	98.7%
2021	Syphilis RDT First Response Syphilis Anti-TP Card Test	Premier Medical Corporation	99.6%	100%

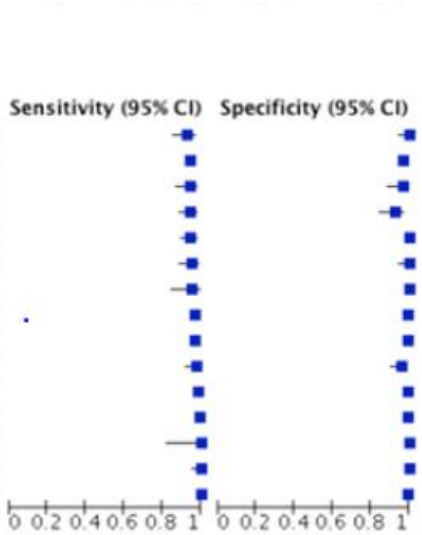
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extranet.who.int/prequal/sites/default/files/document_files/240418_List_of_Prequalified_In_Vitro_Diagnostic_Products.pdf

Laboratory vs field performance of syphilis RDTs

b) Diagnostic test accuracy for syphilis, stratified by evaluation setting

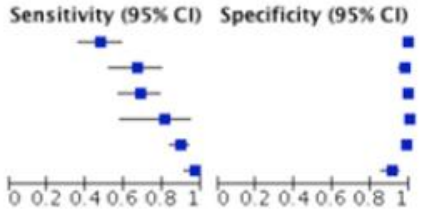
i) Lab evaluation (syphilis, all tests)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
[33] Humphries (SD Bioline)	80	0	6	64	0.93 [0.85, 0.97]	1.00 [0.94, 1.00]
[38] Yin (Medmira)	692	22	43	757	0.94 [0.92, 0.96]	0.97 [0.96, 0.98]
[33] Humphries (MedMira)	81	2	5	62	0.94 [0.87, 0.98]	0.97 [0.89, 1.00]
[37] Bristow	104	6	6	77	0.95 [0.89, 0.98]	0.93 [0.85, 0.97]
[40] Leon	142	0	8	300	0.95 [0.90, 0.98]	1.00 [0.99, 1.00]
[33] Humphries (Chembio)	82	0	4	64	0.95 [0.89, 0.99]	1.00 [0.94, 1.00]
[44] Shakya	42	13	2	9943	0.95 [0.85, 0.99]	1.00 [1.00, 1.00]
[38] Yin (SD Bioline)	710	7	25	772	0.97 [0.95, 0.98]	0.99 [0.98, 1.00]
[38] Yin (Chembio)	713	3	22	776	0.97 [0.96, 0.98]	1.00 [0.99, 1.00]
[39] Shimelis	83	4	2	96	0.98 [0.92, 1.00]	0.96 [0.90, 0.99]
[47] Kalou	639	2	8	341	0.99 [0.98, 0.99]	0.99 [0.98, 1.00]
[35] Bristow	609	4	2	1444	1.00 [0.99, 1.00]	1.00 [0.99, 1.00]
[34] Omoding	19	0	0	201	1.00 [0.82, 1.00]	1.00 [0.98, 1.00]
[30] Ondondo	85	0	0	559	1.00 [0.96, 1.00]	1.00 [0.99, 1.00]
[31] Chiappe	198	2	0	465	1.00 [0.98, 1.00]	1.00 [0.98, 1.00]



ii) Field evaluation (syphilis, all tests)

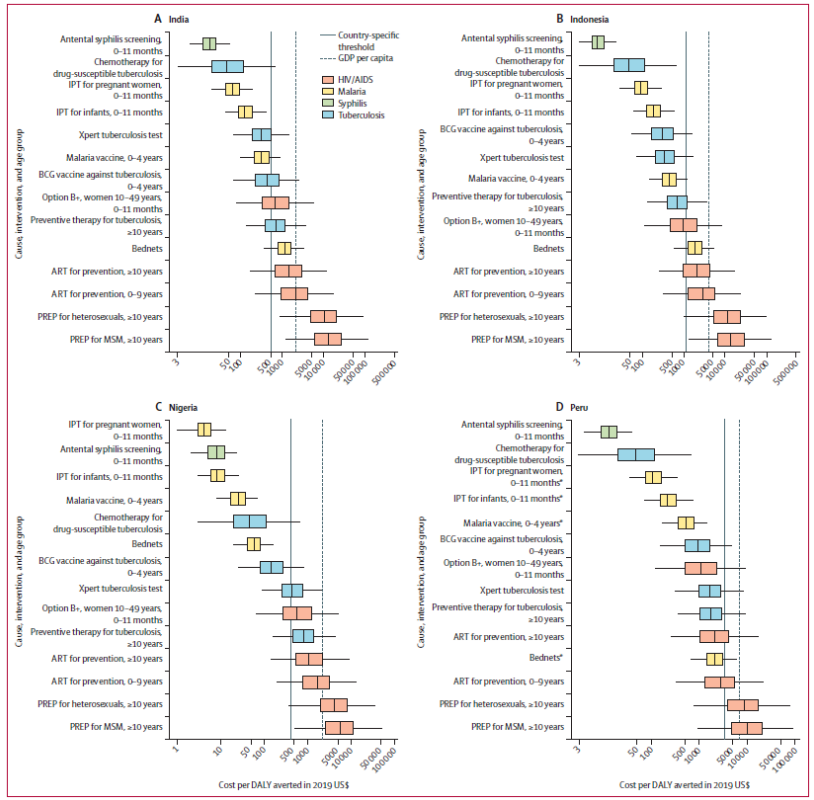
Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
[32] Hess	37	3	41	576	0.47 [0.36, 0.59]	0.99 [0.98, 1.00]
[45] Black	34	4	17	194	0.67 [0.52, 0.79]	0.98 [0.95, 0.99]
[46] Bowen	55	6	25	1702	0.69 [0.57, 0.79]	1.00 [0.99, 1.00]
[43] Bristow	17	0	4	153	0.81 [0.58, 0.95]	1.00 [0.98, 1.00]
[41] Bristow	149	3	18	243	0.89 [0.84, 0.93]	0.99 [0.96, 1.00]
[42] Bristow	109	17	4	168	0.96 [0.91, 0.99]	0.91 [0.86, 0.95]



- Importance of quality assurance programmes for syphilis RDTs in the field
- Implications for use, testing frequency etc.

Gliddon HD et al. Sex Transm Infect 2017

High impact of syphilis screening in pregnancy using rapid diagnostic tests



ANC syphilis screening is one of the most cost-effective interventions

Prevalence of syphilis among adults and adolescents in five sub-Saharan African countries: findings from Population-based HIV Impact Assessment surveys

Mansoor Farahani, Rose Killian*, Giles A Reid, Godfrey Musuka, Owen Mugurungi, Wilford Kirungi, Harriet Nuwagaba-Biribonwoha, Wafaa M El-Sadr, Jessica Justman*

Summary

Background HIV and syphilis are common sexually transmitted infections in sub-Saharan Africa. We aimed to investigate the prevalence and distribution of active syphilis while considering HIV status, demographic characteristics, and behavioural characteristics.

Lancet Glob Health 2024; 12: e1413–23
*Joint first author

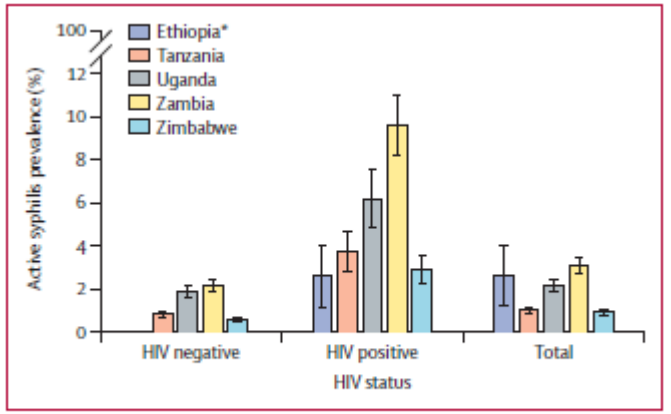


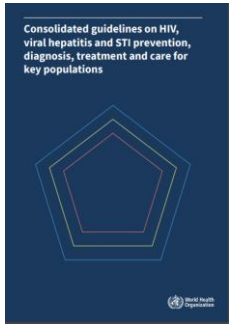
Figure: Prevalence of active syphilis among participants, by country (2015–18)

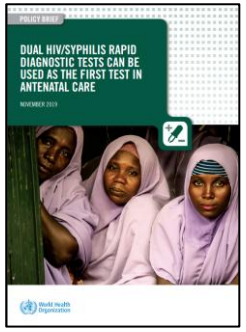
Scale-up of implementation of HIV/syphilis rapid test but implementation evaluation and quality assurance are essential

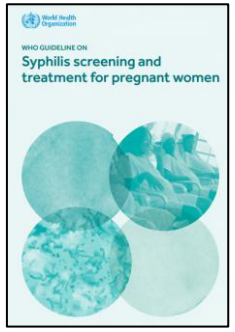
Silke F et al. Lancet Global Health 2024
Farahani M et al. Lancet Global Health 2024

Serological screening for syphilis

- **WHO recommends regular syphilis screening of specific populations**
  - Key populations to reduce burden of infection and prevent complications
  - Pregnant women to prevent adverse outcomes (eMTCT)
- **Laboratory serological testing or rapid diagnostic test**
  - Traditional (NT/T) vs. reverse algorithm (T/NT) to diagnose syphilis
  - HIV/syphilis RDT and syphilis RDT to aid in the diagnosis of syphilis
- **Given the implications of untreated infections, WHO recommends treatment of pregnant women based on positive treponemal antibody test if confirmatory testing is unavailable**







eMTCT (Elimination of Mother-to-Child Transmission), NT (Non-Treponemal), T (Treponemal)

Challenge of diagnosing congenital syphilis

- **Laboratory tests provide indicative results to support the diagnosis but have limitations in sensitivity and specificity**
  - RPR/VDRL titre between mother and newborn (≥ 4-fold higher)
  - IgM detection (FTA-IgM; EIA)
  - Direct *T. pallidum* detection in skin and mucous membrane lesions, CSF, etc. if/when they appear
  - Value of NAAT of other sample types is unclear (blood; mouth; umbilical; placenta; stool etc.)

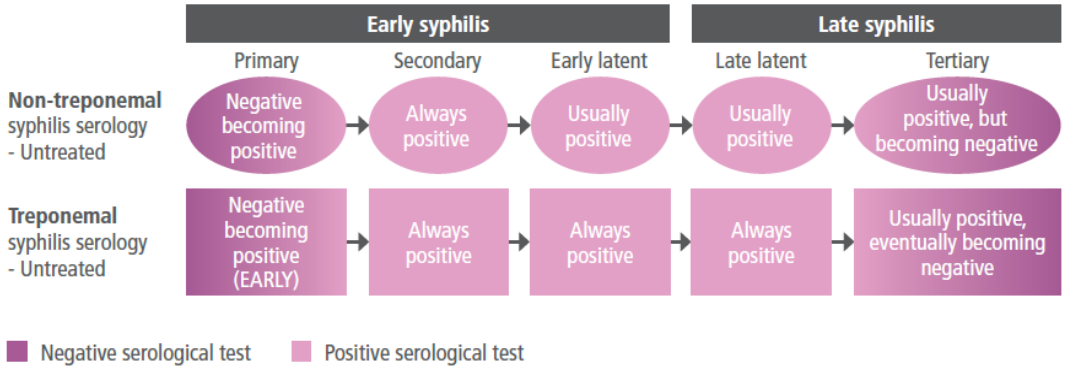


Diagnostic gap: highly sensitive and specific test for diagnosis of (symptomatic and asymptomatic) congenital syphilis that is preferably unlinked from maternal testing

CSF (cerebrospinal fluid), VDRL (Venereal Disease Research Laboratory), FTA-IgM (Fluorescent Treponemal Antibody-Absorption for Immunoglobulin M (IgM) antibodies), RPR (Rapid Plasma Reagin),

Stafford IA et al. New Engl J Med 2024
WHO. Laboratory and POC testing for STIs, 2023

Diagnostic limitation of syphilis serology



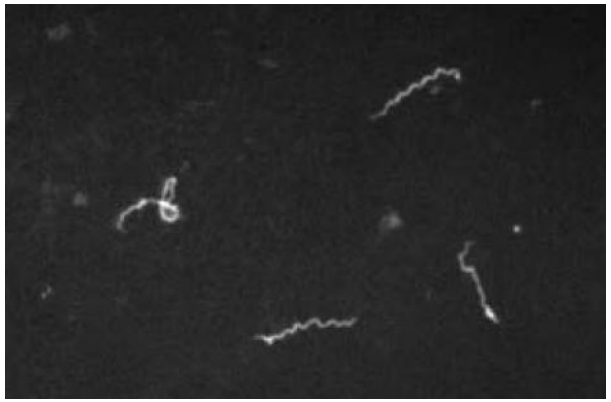
Three major diagnostic gaps due to characteristics of serology:

- Serological tests may be negative in primary syphilis due to window phase
- Negative serology does not rule-out syphilis in people with genital ulcer
- Limited clinical utility of syphilis serology in clinical disease
- **Direct bacterial testing** is required for primary clinical disease

Direct detection of *Treponema pallidum*

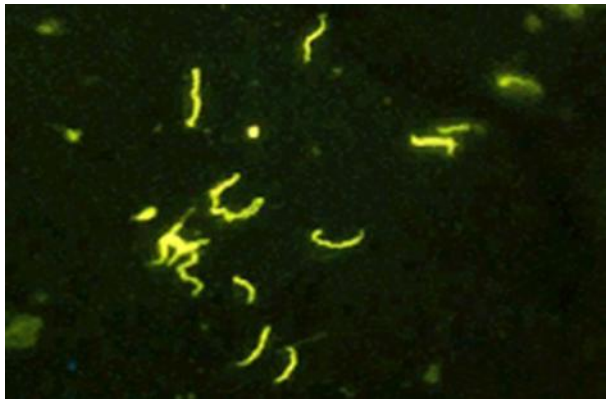
Dark field microscopy

Chancres or moist cutaneous lesions
Cannot be used for rectal/oral specimens
Technical expertise required and labor-intensive
Not commonly used anymore



Direct fluorescent antibody staining

Chancres or moist cutaneous lesions
Oral specimens are acceptable
Technical expertise required and labor-intensive
Not commercially available in many countries



WHO. Laboratory and POC testing for STIs, 2023

Non-serological detection of *Treponema pallidum*

- **High test sensitivity and NPV are required due to implications of untreated infection**
  - Specificity less important as syndromic management is standard of care
  - Serological and clinical review as ‘safety net’

- **Various NAAT assays are used, but no FDA-cleared test is yet commercially available**
  - *T. pallidum* specific and multiplex assays of various composition; no POC test available
  - Sensitivity of NAAT assays varies for primary syphilis (72-95%)

- **Low performance of molecular assays in various samples of exposed newborns: value unclear**
  - Maternal antibodies may persist for >1 year
  - Novel biomarker required to confirm congenital syphilis

NPV=Negative Predictive Value

Peters RPH et al. Lancet 2025
Simpore A et al. Sex Transm Dis 2022

Key messages

- **Objectives of diagnostic testing in STIs**
  - Optimizing treatment and preventing complications including congenital infection
  - Reduction in population-level prevalence and incidence
- **Diagnostic tests for chlamydia and gonorrhoea**
  - Pipeline focused around molecular (NAAT) and antigen-detection technology
  - Point-of-care testing could close diagnostic gaps but uncertain impact at population level
  - Differentiated implementation models essential for success
- **Diagnostic tests for syphilis**
  - Serological screening in pregnancy highly impactful, cost-effective and recommended practice
  - Non-serological tests required for genital ulcer disease given serological window phase
  - Important technological gaps including tests for congenital infection and active disease among previously treated

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Thank you!